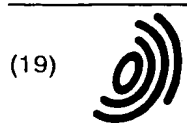


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(54) Open roof construction for a vehicle

(57) An open roof construction for a vehicle having an opening (2) in its fixed roof (1) comprises a frame to be fixed to the roof and a closure element (3) supported by the frame stationary part. Said closure element is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially. An operating mechanism (4) for adjustably supporting said closure element includes a drivably movable driving element (18) and an arm connected thereto by means of a pivot

(17), which arm engages the movable driving element asymmetrically and which effects an adjustment of the closure element (3) by means of said driving element (18) by moving said driving element. The driving element (18) and the arm (16) include mating contacting surfaces (22,23,25,26) formed concentrically round the pivot (17), at least some of which extend substantially perpendicularly to the direction of movement during operation of the operating mechanism (4).

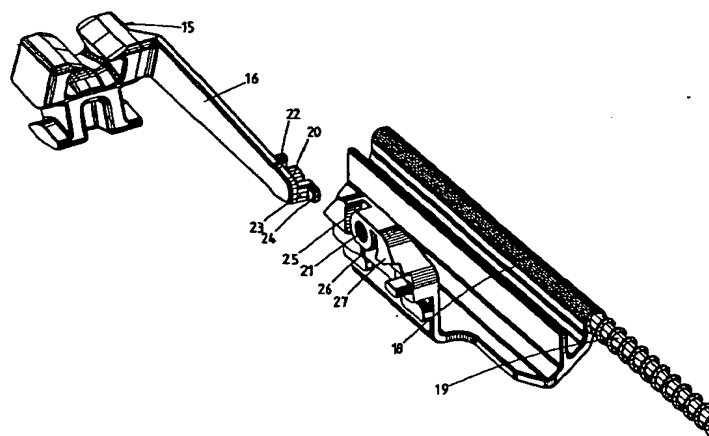


fig.4

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Description

[0001] The invention relates to an open roof construction for a vehicle having an opening in its fixed roof, comprising a stationary part to be fixed to the roof, an adjustable closure element supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism for adjustably supporting said closure element, which operating mechanism includes a drivingly movable driving element and an arm connected thereto by means of a pivot, which arm engages the movable element asymmetrically and which effects an adjustment of the closure element by means of said driving element by moving said driving element.

[0002] Open roof constructions of this kind are known in various versions thereof.

[0003] The object of the present invention is to provide an open roof construction which embodies an improved construction of a pivot between a pivoted arm and a driving element.

[0004] In order to accomplish that objective the invention comprises the characterizing features as defined in the independent claims. Advantageous embodiments of the invention constitute the subject matter of the subclaims.

[0005] The invention provides a hinge construction between an arm and a driving part of an operating mechanism of an open roof construction which is remarkable for being rattle-free and resistant to wear, whilst the pivot is of very simple construction all the same and very easy to mount.

[0006] The invention will now be explained in more detail with reference to the drawings, which schematically show an exemplary embodiment of the invention.

Fig. 1 is a longitudinal sectional view of the embodiment of the open roof construction according to the invention, showing the closure element in an open ventilating position.

Fig. 2 is a larger-scale perspective view of an operating mechanism on one side of the open roof construction of Fig. 1, showing the closure element in the closed position.

Fig. 3 is a perspective, exploded view of the operating mechanism of Fig. 2.

Figs. 4, 5 and 6 are larger-scale perspective of the driving slide and the associated arm of the operating mechanism of Figs. 2 and 3, views along lines IV-IV and V-V, respectively, in Fig. 1, wherein the closure element is shown in the closed position, however.

Fig. 7 is a sectional view along line VII-VII in Fig. 6.

[0007] The open roof construction as shown in the drawings constitutes the subject matter of further

compending patent applications of the same date, whose contents are incorporated herein by reference thereto.

[0008] The drawings show a fixed roof 1 of a vehicle, such as a passenger car, which is provided with a roof opening 2 for receiving an open roof construction. The open roof construction includes a closure element 3 for selectively closing or at least partially releasing the roof opening 2. In this embodiment the closure element 3 is a rigid panel, in particular a transparent panel of glass or plastic material, but also other closure elements such as slats or a flexible cover are conceivable. In the illustrated embodiment a sliding-tilt roof is used, wherein panel 3 can be moved from the closed position in roof opening 2 (Figs. 2, 3), on the one hand to an upwardly and rearwardly sloping ventilating position (Fig. 1) and on the other hand downwards (Fig. 5) and subsequently rearwards to a position under the fixed roof 1. Also other embodiments are possible, however.

[0009] In order to enable the movements of panel 3, panel 3 is fitted with an operating mechanism 4 at both edges extending in the longitudinal direction of the open roof construction, which operating mechanisms each include a link slide 5 in this embodiment, which is slidably accommodated in a guideway of a guide rail 6. Said guide rail 6 is mounted on or forms part of a stationary part (not shown), for example a frame, which is attached to the fixed roof 1 of the vehicle. The guide rails 6 extend along the longitudinally extending edges of the roof opening 2 and possibly rearwards thereof.

[0010] Part of the operating mechanism 4 is made up of a link 7, which is attached to the underside of panel 3, near the respective longitudinal edge, and that to a stiffening frame 8 thereof. At its front end link 7 is fitted with a sliding shoe 9, which is slidably accommodated in associated grooves in guide rail 6, and which also functions as the front hinge for panel 3. Link slide 5 comprises two pairs of sliding shoes 10, which project laterally and which guide link slide 5 upon its movement in vertical direction in guide rail 6.

[0011] Both link slide 5 and link plate 7 include guideways in the form of laterally projecting ribs 11, 12, wherein ribs 11 are formed on the lower edge of link plate 7 and extend away from each other, whilst ribs 12 are formed on the upper side of vertical walls 13, 14 of the link slide and extend towards each other. A guide head 15 is in engagement with all ribs 11 and 12, and to that end it engages between the vertical walls 13, 14 of link slide 5 and round link plate 7.

[0012] As is shown in particular in Figs. 4 - 6, guide head 15 is formed unilaterally, and consequently asymmetrically, on the free end of an arm 16. On its side remote from guide head 15 arm 16 is pivotally connected, via a pivot 17, to a driving slide 18 (see also Fig. 1), which is drivingly connected to a drive unit, such as an electric motor, a hand crank or the like, via a pressure-rigid driving cable 19 or the like. By moving the guide head 15, which acts as a wedge between link slide 5 and link plate 7, with respect to guideways 11,

12, link plate 7 and thus panel 3 will be pivoted about pivot 9. Link slide 5 is stationary during said pivoting of panel 3. In the lower pivoted position of panel 3 the driving slide 18 is locked in position with respect to link slide 5, after which the entire operating mechanism 4 and panel 3 will move rearwards as one unit upon further rearward movement of the driving slide 18.

[0013] The construction of pivot 17 is clearly shown in Figs. 4 - 6. Pivot 17 comprises a pin 20 which extends horizontally, seen in transverse direction, at the end of arm 16 remote from guide head 15. Pin 20 can be inserted in axial direction into a hole 21 of driving slide 18. A first projection 22 and a second projection 23 are concentrically disposed round pin 20 on arm 16. The second projection 23 is formed on the end of arm 16, it furthermore comprises a further projection 24, which extends transversely to second projection 23 and parallel to arm 16 and, in mounted position, to guide rail 6.

[0014] In the mounted position of pivot 17 in driving slide 18, projections 22 - 24 can mate with associated recesses, viz, a first recess 25 for first projection 22 and a second recess 26 for second projection 23 and said further projection 24. The first projection 22 and the second projection 25 are both formed round hole 21 of pivot in the form of a circular segment, with the first recess 25 being open on their upper and lower sides. First projection 22 and first recess 25 have mating contacting surfaces, which extend substantially perpendicularly to the direction of movement of driving slide 18 and which are consequently capable of absorbing driving forces from driving slide 18 on arm 16.

[0015] Second projection 23 and second recess 26 possess corresponding stop surfaces, which likewise extend concentrically round pivot 17. In mounted condition, further projection 24 mates with a further wall 27 which closes part of second recess 26, as a result of which said further projection and said further wall 27 can function to lock pin 20 in position in hole 21, in that further projection 24 and further wall 27 are in engagement within the normal pivoting range of arms 26, as is shown in Figs. 6 and 7.

[0016] Second recess 26 is closed on the upper side and only open on the lower side, and as a result of the construction of further projection 24 and further wall 27, said second projection and said further projection 24 can only be inserted into the second recess 26 by inserting pin 20 into hole 21 in the mounted position of arm 16 (Fig. 6), which lies outside the normal pivoting range of said arm 16 (Fig. 5). In this position the stop surfaces of first projection 22 and first recess 25, as well as the stop surfaces of second projection 23 and further projection 24 with second recess 26 are not in engagement with each other. By pivoting arm 16 from this position to the normal operative position, wherein arm 16 includes a small angle with the horizontal, the projections 22 - 24 and the associated recesses 25 - 26 will move into engagement with each other, and further projection 24 will move behind the further wall 27 of driving

slide 18, as a result of which pin 20 is locked in position in hole 21, thus forming pivot 17.

[0017] In the mounted position as shown in Fig. 6, first projection 22 also functions as a stop against the upper side of driving slide 18, so that said driving slide limits the pivoting movement and determines when pin 20 can be withdrawn from hole 21.

[0018] Projections 22 - 24 are formed slightly larger than recesses 25, 26, as a result of which projections 22 - 24 will be received in recesses 25 - 26 with some friction, thus providing a connection which is free from play. Since the angular displacements of arm 16 during operation of the operating mechanism are only small, said friction will not have an adverse effect on the operation. Since arm 16 with guide head 15 is positioned asymmetrically with respect to pivot 17, moments will be exerted on pin 20 and hole 21, which can be absorbed by the contacting surfaces of projections 22 - 24 and recesses 25, 26. In this manner a very stable pivot 17 is provided, with projections 22 - 24 mainly having a guiding and force absorption function, whilst in addition further projection 24 performs a locking function, which ensures that the pivot is easy to mount and that it can be locked in the operative position without additional parts being required.

[0019] The invention is not limited to the above-described embodiment as shown in the drawing, which can be varied in several ways without departing from the scope of the invention. Thus the driving element may consist of other movable parts, which are connected to an arm. The arm may for example also consist of a lever or the like. The locking surfaces for locking a pin axially in a hole so as to form a pivot can also be used in other parts of the open roof construction according to the invention.

Claims

1. An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting said closure element, which operating mechanism includes a drivingly movable driving element (18) and an arm (16) connected thereto by means of a pivot (17), which arm engages the movable driving element asymmetrically and which effects an adjustment of the closure element by means of said driving element by moving said driving element, characterized in that said driving element (18) and said arm (16) include mating contacting surfaces (22, 23, 25, 26) formed concentrically round said pivot (17), at least some of which extend substantially perpendicularly to the

direction of movement during operation of the operating mechanism (4).

2. An open roof construction according to claim 1, wherein said driving element (18) and said arm (16) also include further contacting surfaces (24, 27) which extend substantially parallel to the direction of movement. 5
3. An open roof construction according to claim 1 or 2, wherein said contacting surfaces are formed on at least one projection (22, 23) and a recess (25, 26) in said driving element (18) and/or in said arm (16). 10
4. An open roof construction according to claims 2 and 3, wherein said projection (22, 23) is formed on said arm (16) and wherein said recess is formed in said driving element (18). 15
5. An open roof construction according to any one of the claims 2 - 4, wherein two diametrically opposed projections (22, 23) are formed on said arm (16). 20
6. An open roof construction according to any one of the preceding claims, wherein said pivot (17) is formed of a pin (20) on the arm (16), which is axially inserted into a hole (21), whilst said arm (16) can be pivoted to a mounting position outside the normal pivoting range during the operation of the operating mechanism (4), and wherein said further stop surfaces (24, 27) are so positioned that they are in engagement with each other within the normal pivoting range of the arm (16) and that they are out of engagement in the mounting position of the arm. 25 30 35
7. An open roof construction according to any one of the claims 2 - 6, wherein said further contacting surfaces (24) are formed on the projection (23) which is preferably positioned at the end of the arm (16). 40
8. An open roof construction according to any one of the preceding claims, wherein said driving element (18) is made up of a driving slide, whilst said arm (16) supports a guide head (15) at the end remote from the driving slide, which guide head is in engagement with at least the guideway (11) on a link plate (7) of the closure element, and which is preferably also in engagement with a further guideway (12) on a link slide (5), wherein the adjustment of the closure element is effected by the wedge-like movement of the guide head (15) along said guideways (11, 12). 45 50
9. An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in 55

which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting said closure element, which operating mechanism includes a drivingly movable driving element (18) and an arm (16) connected thereto by means of a pivot (17), which arm engages the driving element (18) asymmetrically and which effects an adjustment of the closure element by moving said driving element, wherein said pivot (17) is made up of a pin (20) which fits in a hole (21) and which can be inserted into said hole in axial direction, **characterized in that** said driving element (18) and said arm (16) include at least one projection (22, 23) and mating recess (25, 26) disposed concentrically round said pivot (17), which are formed in said driving element (18) and/or in said arm (16) and which include mating stop surfaces.

10. An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting said closure element, which operating mechanism includes a drivingly movable driving element (18) and an arm (16) connected thereto by means of a pivot (17), which arm engages the driving element asymmetrically and which effects an adjustment of the closure element by moving said driving element, wherein said pivot (17) is made up of a pin (20) which fits in a hole (21) and which can be inserted into said hole in axial direction, **characterized in that** said driving element (18) and said arm (16) include stop surfaces (24, 27) which extend substantially parallel to the direction of movement, whilst said arm (16) can be pivoted to a mounting position outside the normal pivoting range during the operation of the operating mechanism (4), and wherein said stop surfaces (24, 27) are so positioned that they are in engagement with each other within the normal pivoting range of the arm (16), effecting an axial locking engagement of said pin (20) in said hole (21), and that they are out of engagement in the mounting position of the arm (16), thereby allowing insertion and removal of the pin (20).
11. An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open posi-

tion, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting said closure element, which operating mechanism includes an element (18) and an arm (16) connected thereto by means of a pivot (17), which arm engages said element (18), wherein said pivot (17) is made up of a pin (20) which fits in a hole (21) and which can be inserted into said hole in axial direction, **characterized in that** said element (18) and said arm (16) include stop surfaces (24, 27) which extend substantially perpendicularly to said pivot, whilst said arm (16) can be pivoted to a mounting position outside a normal pivoting range during operation, and wherein said stop surfaces (24, 27) are so positioned that they are in engagement with each other within the normal pivoting range of the arm (16), effecting an axial locking engagement of said pin (20) in said hole (21), and that they are out of engagement in the mounting position of the arm (16), thereby allowing insertion and removal of the pin (20).

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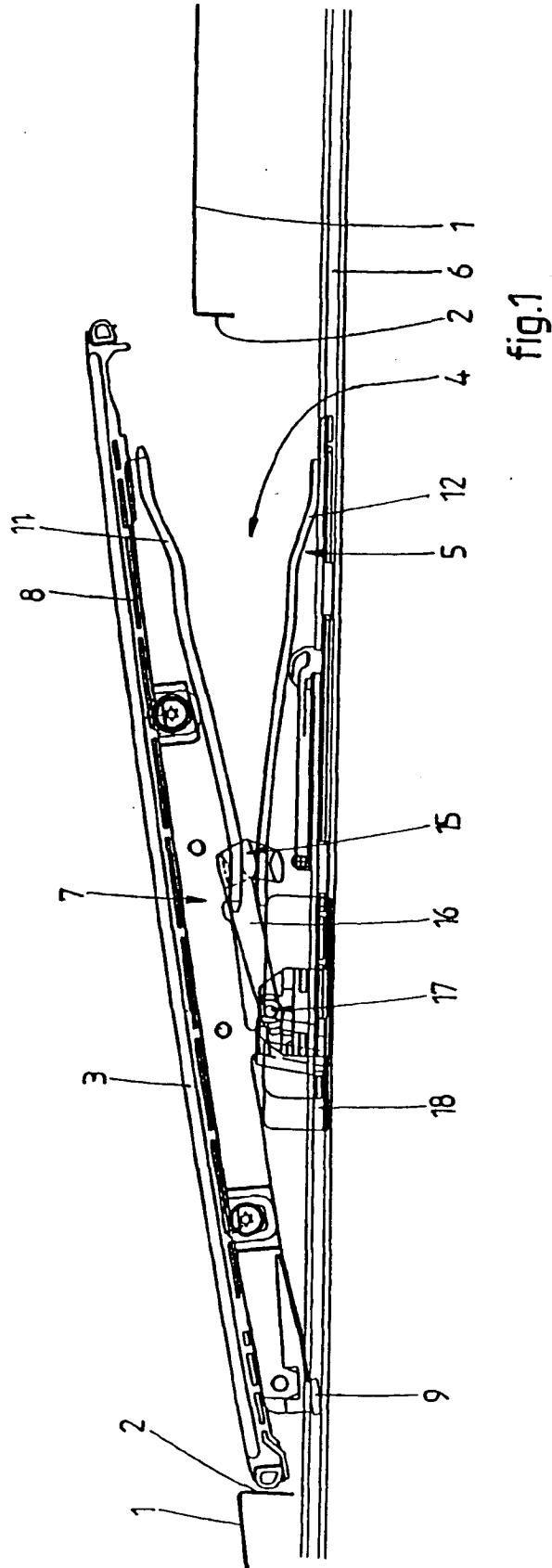
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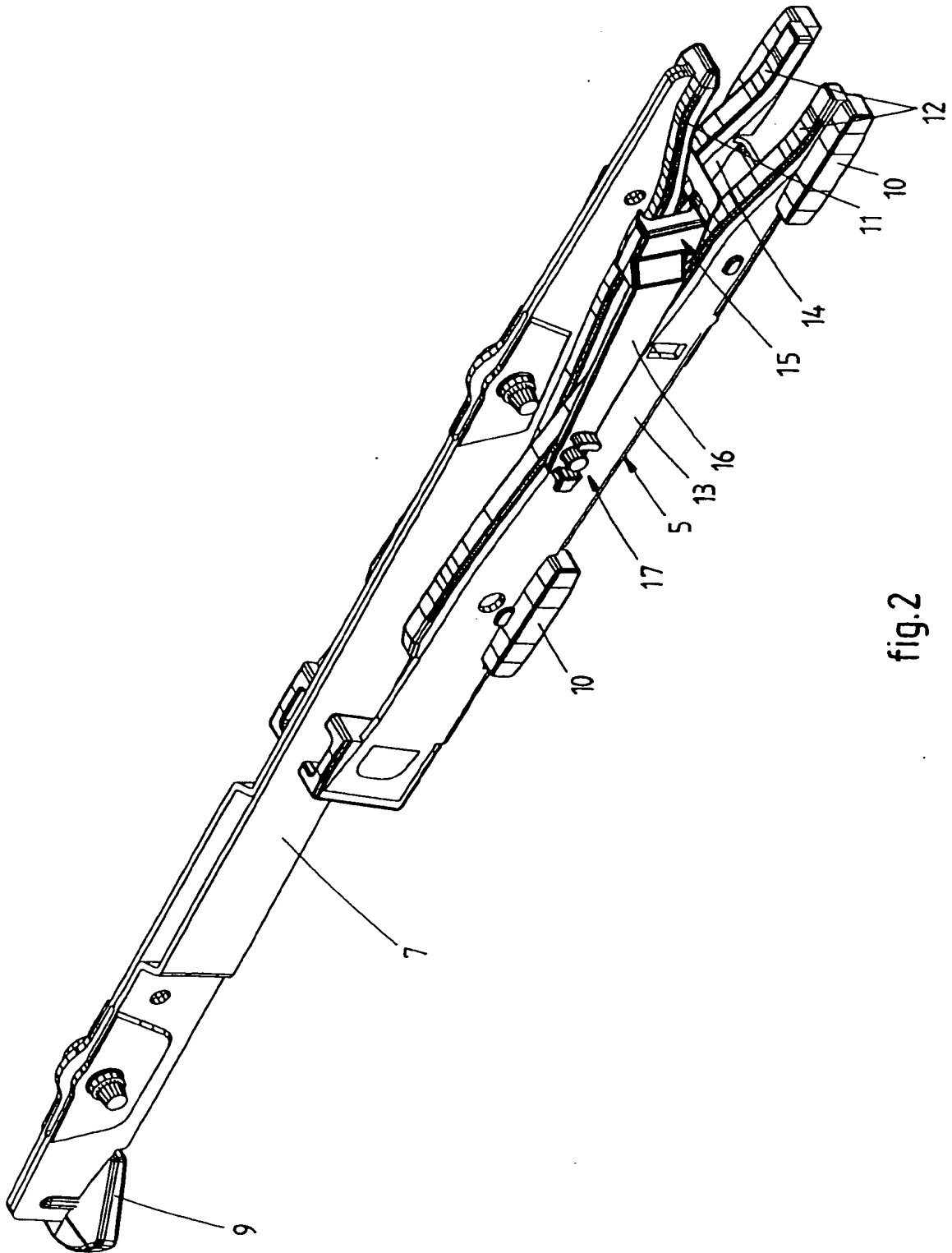


fig.2

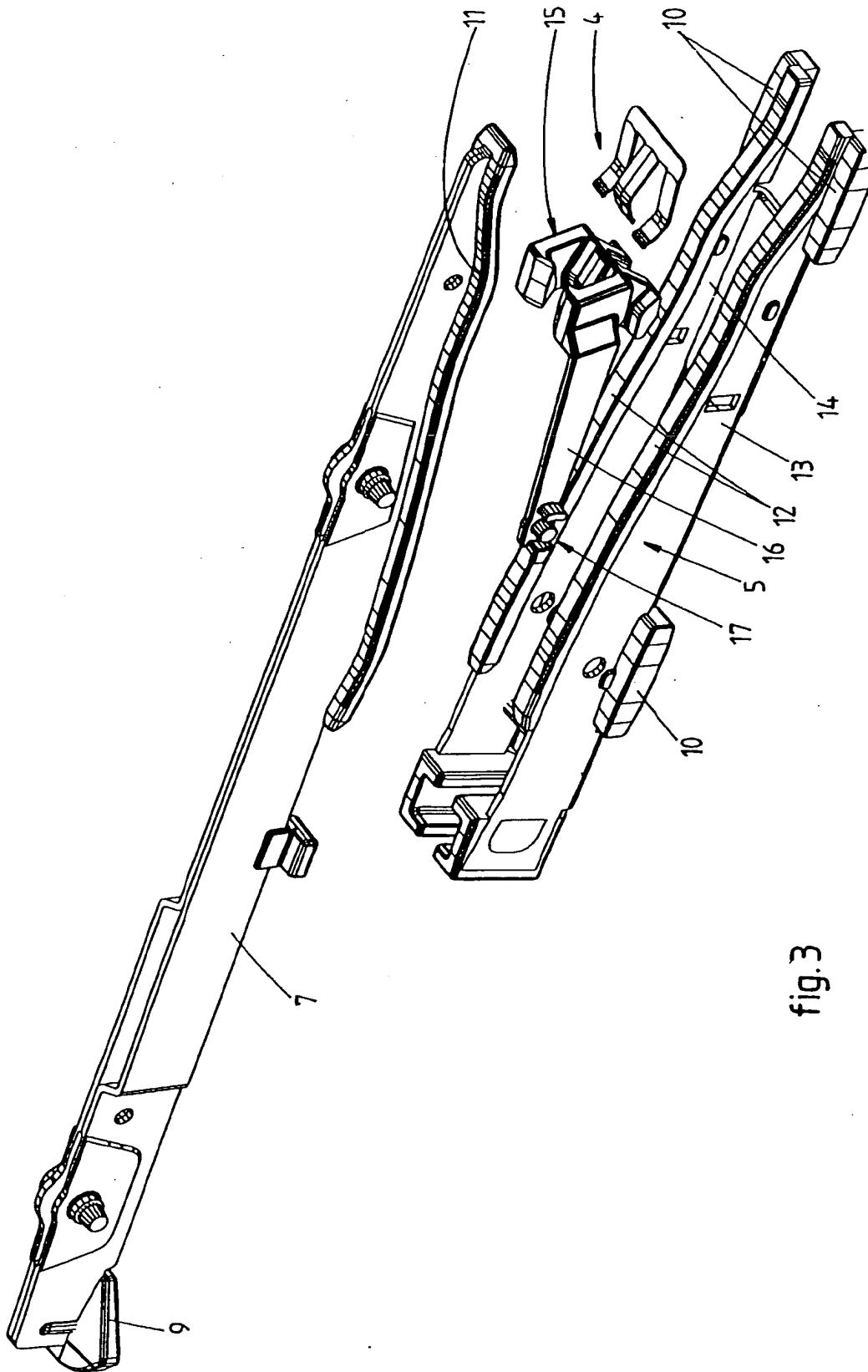


fig.3

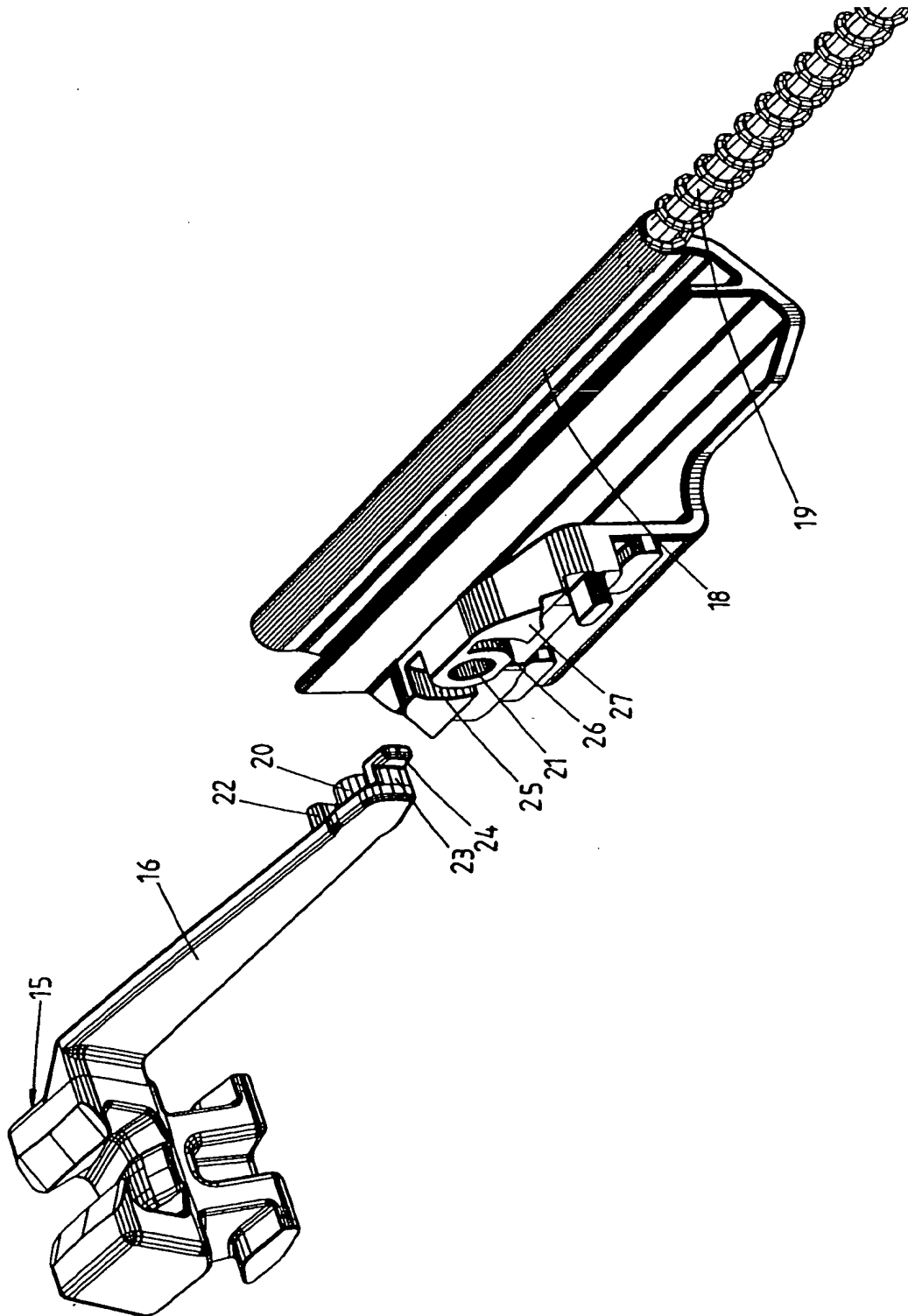


fig.4

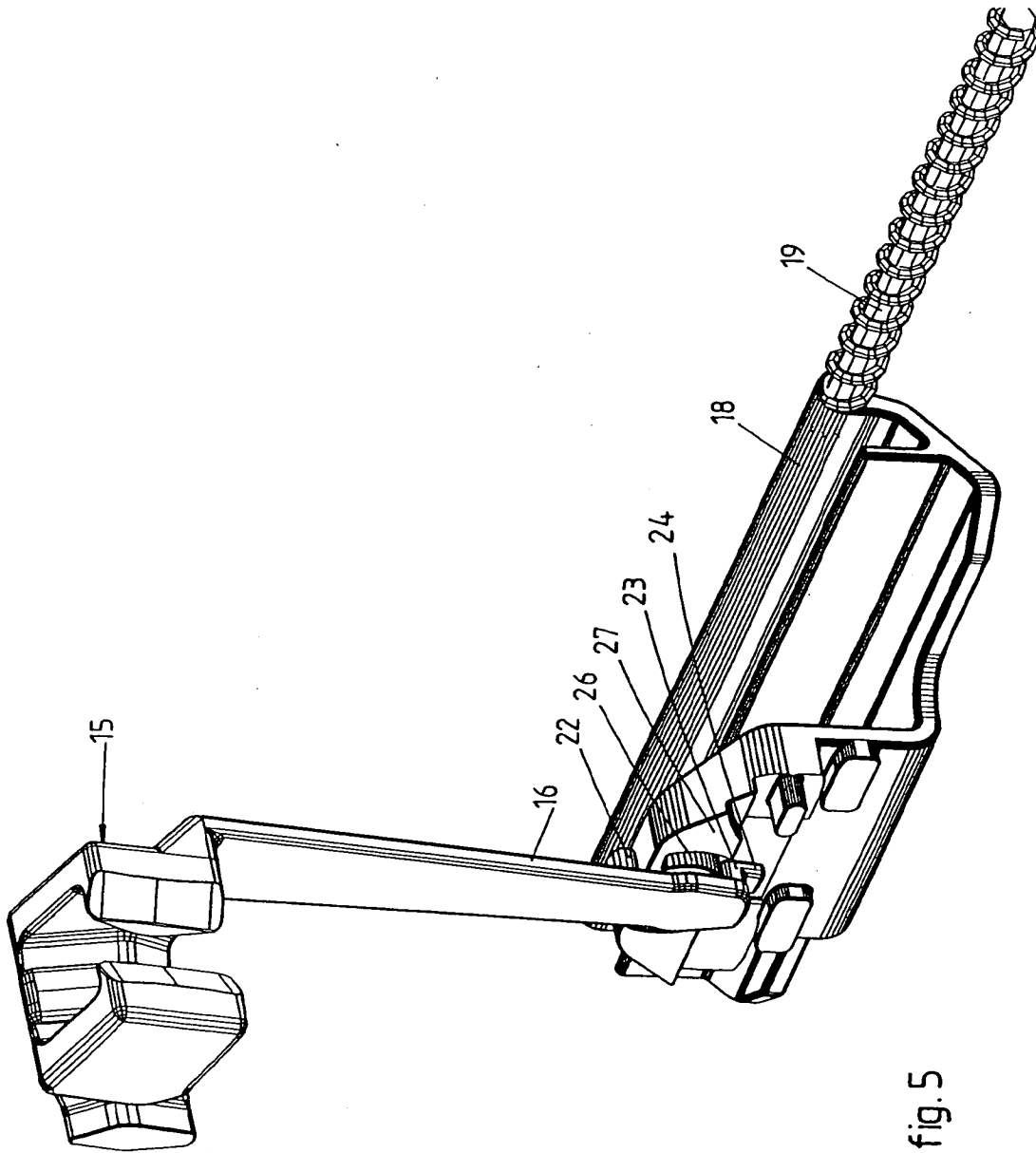


fig. 5

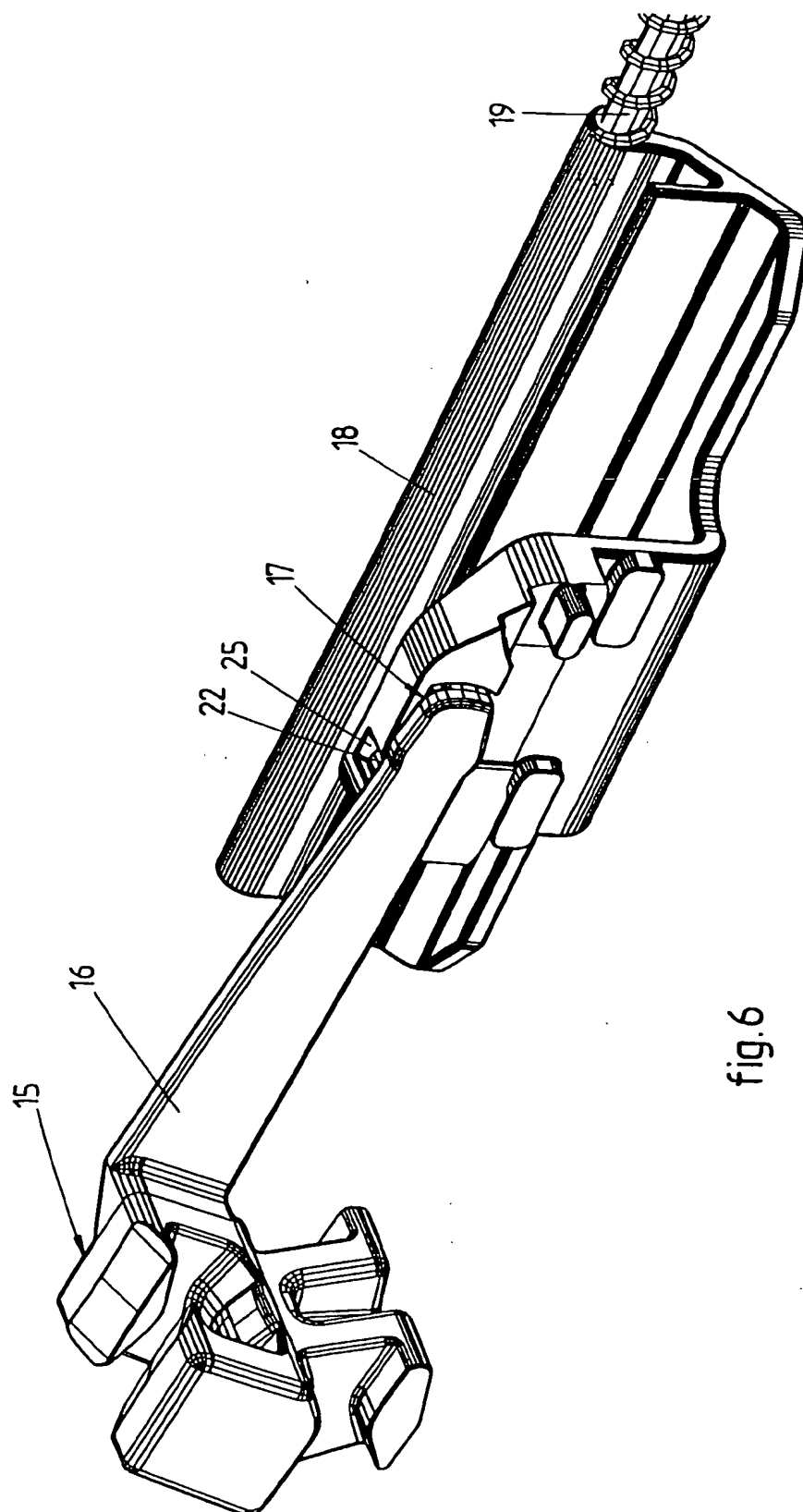


fig. 6

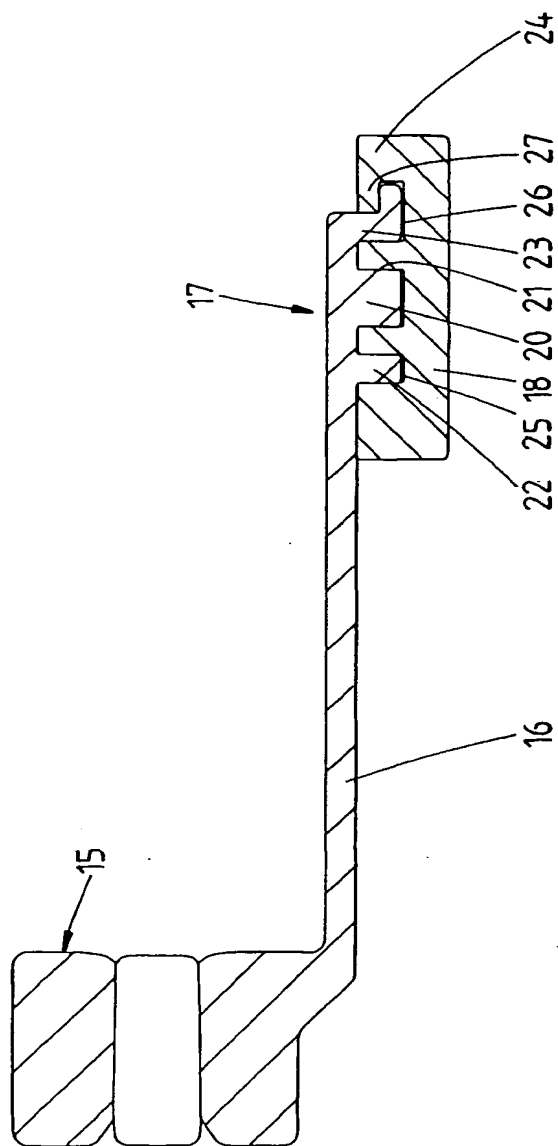


fig.7



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 2267

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 527 085 A (OCHIAI HIRONORI ET AL) 18 June 1996 (1996-06-18) * column 3, line 57 - column 4, line 2; figures 4,6,7 *	1,9-11	B60J7/02
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		13 October 2000	Foglia, A
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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